# The impact of introducing real time feedback on ventilation rate and volume by ambulance clinicians in out of hospital cardiac arrest: the VANZ2 study

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**Fig 1. Zoll Accuvent**

**Fig 2. Zoll Accuvent feedback shown in BVM box**


**Background.** Adequate ventilation is an important aspect of high quality cardio pulmonary resuscitation (CPR). The European Resuscitation Council (ERC) recommends ventilating cardiac arrest patients at a rate of 8-12 per minute with a tidal volume of 500-600 ml and warns against hyperventilation. Research suggests rescuers frequently deliver excessive ventilations during CPR and that hyperventilation is associated with increased intrathoracic pressure, impaired haemodynamics and cerebral vasoconstriction which are known to be deleterious to survival. VANZ1, a manikin-based study ran in North East Ambulance Service (NEAS) NHS Foundation Trust, demonstrated a significant improvement in compliance with ERC ventilation recommendations during CPR using the Zoll Accuvent feedback device (figs 1 & 2). The VANZ2 study aimed to determine whether introducing real time ventilation feedback improved compliance with ventilation recommendations in clinical practice during CPR.

**Fig 3. Stepped wedge cluster method**

| | Months | | | | | |
|---|---|---|---|---|---|---|
| **Clusters** | **M1** | **M2** | **M3** | **M4** | **M5** | **M6** |
| **C1** | Ctrl | Ctrl | Int | Int | Int | Int |
| **C2** | Ctrl | Ctrl | Ctrl | Int | Int | Int |
| **C3** | Ctrl | Ctrl | Ctrl | Ctrl | Int | Int |

**Method.** A stepped wedge, cluster randomised trial using three NEAS ambulance stations over six months (fig 3). Adult cardiac arrest patients who were resuscitated and where a study crew were first on-scene were eligible for recruitment. Traumatic cardiac arrests and suspected pregnancy were excluded. The primary outcome was % ventilations delivered in compliance with ERC recommendations. Secondary outcomes included survival to 30 days. The project was supported by Zoll and the North East and North Cumbria Academic Health Sciences Network.

**Results**. Between 1st August 2021 and 31st January 2022 eighteen patients (mean age 58 years (SD 17), 50% male) were enrolled into the trial although only 14 provided ventilation data and only one patient survived to 30 days. The trial failed to recruit the anticipated number of patients for the planned analysis (n=48) so descriptive results are presented (fig 4).

**Fig 4. Descriptive results**

| | Control (No feedback) | Intervention (Feedback) |
|---|---|---|
| Number of patients | 11 | 3 |
| Mean ventilation rate (breaths per minute) | 14 | 17 |
| Ventilation rate in target (%) | 18 | 46 |
| Mean ventilation volume (mls) | 467 | 563 |
| Ventilation volume in target (%) | 20 | 52 |
| Ventilation rate & volume in target (%) | 3 | 25 |


**Conclusion.** The VANZ2 trial showed that ventilations are rarely delivered in line with guidelines and that feedback may improve compliance. The trial failed to recruit the necessary numbers of patients to demonstrate any statistical differences so needs to be interpreted with caution. The low recruitment may be due to multiple factors including the small size of the study, issues keeping trial devices on trial stations and the immense background pressures due to COVID that staff were dealing with at the time. The impact of delivering better ventilation rates and volumes, as part of an overall high-quality CPR package, needs further investigation.